

July 11, 1999

MEMORANDUM

SUBJECT: OCCUPATIONAL AND RESIDENTIAL EXPOSURE ASSESSMENT  
AND RECOMMENDATIONS FOR THE REREGISTRATION  
ELIGIBILITY DECISION DOCUMENT FOR TRICHLORFON

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Please find the review of Trichlorfon.

DP Barcode: D257671

Pesticide Chemical Codes: 057901

EPA Reg Nos.: 655-790, 655-791, 3125-9, 3125-371, 3125-184, 3125-400,  
3125-449, 3125-406, 3125-507, 8660-71, 9198-110, 19713-  
220, 32802-29, and 3125-184-AK, 3125-184-CA.

EPA MRID No.: None.

PHED: Yes, Version 1.1 (Surrogate Exposure Guide, August, 1998)

## EXECUTIVE SUMMARY

This document contains the occupational and residential exposure assessment for residential perimeter, livestock premise, turf (broadcast and spot treatments), and ornamental uses of trichlorfon. The document also includes potential risk mitigation measures including personal protective equipment (PPE) and engineering controls for handlers and entry restrictions for postapplication activities. The scope of the document covers both occupational and residential uses; the occupational uses include both WPS (i.e., nursery uses) and nonWPS uses (all non-nursery uses).

Trichlorfon is an organophosphate insecticide used to control various insects such as lepidopteran larvae (caterpillars), white grubs, mole crickets, sod webworms, leaf miners, and stink bugs. Trichlorfon also is applied to control flies, ants, cockroaches, earwigs, crickets, and pillbugs. Special local needs labels for Arkansas and California permit application to commercially operated freshwater ponds to control predaceous diving beetle, water scavenger beetle, water boatman backswimmer, water scorpions, and giant water bugs. Trichlorfon is formulated as a granular product and a soluble powder. A wide variety of application techniques have been identified that could potentially be used to apply trichlorfon, including groundboom, low and high pressure handwand, backpack, and handgun sprayers, sprinkling can (spot treatment), push-type granular spreaders, and irrigation systems. Also dry baits can be “sprinkled” out of a cup or spoon or put onto cardboard or plastic or applied as a mound treatment for ants and dry bait mixed with water can be “sprinkled” out of a cup or watering can. Granular formulations may be applied to cracks, crevices and wall voids. Application rates for turf crops range from 1.1 to 8.2 lb ai/acre; maximum ornamental rate is 0.015 lb ai/gallon for soluble powder formulations, the maximum rate for livestock building treatment is 0.0002 lb ai/ft<sup>2</sup>, the perimeter treatments have high end rates ranging from 0.0000125 to 0.000062 lb ai/ft<sup>2</sup>, shaker cans have a maximum rate of 0.062 lb ai/can, and Texas Harvester ant mound treatments are applied using high end rates ranging from 0.013 to 0.025 lb ai/mound. These rates are intended to reflect the upper range of application rates on the labels. Finally, applications of trichlorfon also include foliar treatments to ornamentals and drench treatment of narcissus and treatment to commercially operated freshwater ponds and tanks.

The exposure duration for short-term assessments is 1 to 7 days. Intermediate-term durations are 7 days to several months. Although information is not available to determine what percentage of applicators apply trichlorfon for more than 7 days, it is reasonable to believe that uses of trichlorfon by commercial operators may encompass an intermediate-term duration. Private applicators are not expected to apply trichlorfon for more than seven days per year, and therefore, are only assessed using the short-term endpoint. No chronic (i.e., more than 180 days per year) uses have been identified.

No **handler** exposure studies were conducted by the registrant and submitted to the Agency. Surrogate data from the Pesticide Handlers Exposure Database (PHED) Version 1.1, were used to assess the potential exposures resulting from handling trichlorfon. Potential exposures were calculated using unit exposures multiplied by the amount of trichlorfon handled per day (i.e., lb ai/day). The amount of trichlorfon assumed handled per day was derived from the various application rates and the number of acres (or gallons of spray solution) that could be applied in a single day. Dermal and inhalation margins of exposure (MOEs) are presented separately along with a combined total MOE. The total MOE is used to assess the hazard.

The **results of the handler** assessments indicate that some of the **occupational handlers** risks from combined dermal and inhalation exposures exceed the level of concern (i.e., the MOE <100) at **maximum risk mitigation** (i.e., maximum PPE, since engineering controls are not feasible). These scenarios include mixing/loading/applying with a low-pressure handwand sprayer to 15 acre-foot commercial ponds at the application rate of 0.64 and 1.4 lb ai/acre-foot of pond (MOEs of 58 and 27); and mixing/loading/applying with a low-pressure handwand sprayer to 7.5 acre-foot commercial ponds at the application rate of 0.64 lb ai/acre-foot of pond (MOE = 53).

The results of the **residential handler** assessment indicate that some of the residential handler risks from combined dermal and inhalation exposures exceed the level of concern (i.e., the MOE <1,000). These scenarios include mixing/loading/applying granules to residential lawns using a “push-type” broadcast spreader at the high application rate (MOE of 540 to 810); applying granules to building perimeters using “hand broadcast” method at the high application rate (MOE = 450); and applying granules to ant mounds using “hand broadcast” method at the high and low application rate (MOEs of 130 and 240).

No **postapplication** exposure studies were conducted by the registrant. Therefore, postapplication exposures to occupational workers and residents were estimated using assumptions for a surrogate postapplication assessment presented in the Standard Operating Procedures (SOPs) for Residential Exposure Assessments. These data were used in this assessment in conjunction with HED standard values for transfer coefficients to assess potential exposures to workers reentering treated sites. The **results of the occupational postapplication** assessments indicate that entry restrictions need to be established for WPS uses and they range up to 26 days for cutting, harvesting, transplanting, pruning, and balling/burlapping ornamentals. For nonWPS uses, entry by golf course workers to mow and maintain the turfgrass did not exceed EPA’s level of concern on day of application as soon as the dust has settled. In addition, the entry by golfers on the day of application did not exceed EPA’s level of concern. Other nonWPS uses patterns did not lend themselves to traditional postapplication risk assessments.

The results of the **residential postapplication** assessments indicate that risks exceed EPA’s level of concern for dermal postapplication exposures and risk to toddlers reentering treated lawns, for the incidental oral ingestion of granular pellets by toddlers and for oral hand-to-mouth exposure by toddlers when turf is treated using an application rate of 8.1 lb ai/acre. Also, all combined dermal and incidental ingestion exposures assessed for toddlers exceeded EPA’s level of concern, particularly for the dermal/-pellet ingestion estimates.

Relatively few incidents of illness have been reported due to trichlorfon based on the Incident Data System, Poison Control Center Data, or the California Pesticide Illness Surveillance Program. According to literature reports, where humans were administered doses of trichlorfon, 5 mg/kg was the associated dose with persons experiencing symptoms such as red cell cholinesterase, plasma cholinesterase depression, nausea, vomiting, and/or diarrhea.

The handler and postapplication assessments are believed to be reasonable high end representations of trichlorfon uses. There are, however, many uncertainties in these assessments. The uncertainties include but are not limited to the following:

C several generic protection factors were used to calculate handler exposures and these protection

- factors have not been completely evaluated and accepted by HED;
- C not all of the PHED exposure data are of high confidence because of the lack of replicates and/or inadequate QA/QC in the studies;
- C no chemical-specific exposure or transferable residue data were submitted and as a result, all analyses were completed using surrogate data from sources such as PHED and assumptions related to the behavior and environmental fate of trichlorfon in the environment (e.g., dissipation of transferable residues);
- C extrapolating exposure and DFR data by the amount of active ingredient handled or applied;
- C factors used to calculate postapplication risks (e.g., hours exposure per day or average reentry day) are often based on the best professional judgment due to a lack of pertinent data.

These uncertainties are inherent in most pesticide exposure assessments. The conservative nature of the assessments, however, are believed to be protective of the handlers and reentry workers.

## BACKGROUND

### Purpose

In this document, which is for use in EPA's development of the trichlorfon Reregistration Eligibility Decision Document (RED), EPA presents the results of its review of the potential human health effects of occupational and residential exposure to trichlorfon.

### Criteria for Conducting Exposure Assessments

An occupational and/or residential exposure assessment is required for an active ingredient if (1) certain toxicological criteria are triggered and (2) there is potential exposure to handlers (mixers, loaders, applicators, etc.) during use or to persons entering treated sites after application is complete. For trichlorfon, both criteria are met.

### Summary of Toxicity Concerns Relating to Occupational and Residential Exposures

Table 1 presents the acute categories as outlined in the Hazard Identification Document.

**Table 1: Acute Toxicity Categories for Trichlorfon (technical)**

Guideline Number	Study Type	Toxicity Category
81-1	Acute Oral	II
81-2	Acute Dermal	II
81-3	Acute Inhalation	III
81-4	Primary Eye Irritation	III
81-5	Primary Dermal Irritation	IV
81-6	Skin Sensitization	NA

### Other Endpoints of Concern

On May 12, 13, and 14, 1998 the Health Effect Divisions Hazard Identification Assessment Review Committee (HIARC) met to review the organophosphates. This included the review of past toxicological decisions and discussion of any FQPA Concerns (Rowland, Jess. Organophosphates: A comprehensive review for FQPA. Memorandum from Jess Rowland to Lois Rossi through K. Clark Swentzel and Mike Metzger, 6/3/98). The committee identified a dermal NOAEL of 100 mg/kg/day

for short and intermediate-term dermal exposure assessments. It is based on a 21-day dermal toxicity study in rabbits. An inhalation NOAEL of 0.0127 mg/L (3.45 mg/kg/day) was also identified, based on a 21-day inhalation study in SPF Wistar II rats. On June 2, 1999, the HIARC selected the NOAEL of 10 mg/kg/day (1-day oral rat study) for acute dietary risk assessment which is used for nondietary ingestion routes (e.g., hand-to-mouth activities).

On June 15, 1998 the Health Effect Divisions FQPA Safety Factor Committee evaluated hazard and exposure data for trichlorfon and recommended that the 10x safety factor be retained for trichlorfon. This decision was based on evidence of 1) Organophosphate Induced Delayed Neurotoxicity (OPIDN), 2) neuropathy in hens in the Acute Delayed Neurotoxicity Study, 3) literature citations of developmental toxicity in guinea pigs in which oral administration of trichlorfon resulted in decreased brain weights, and 4) numerous data gaps.

**Table 2: Endpoints for Assessing Occupational and Residential Risks for Trichlorfon**

ENDPOINT	DOSE	MARGIN OF EXPOSURE	EXPOSURE SCENARIO
Acute oral	Oral NOAEL 10 mg/kg/day	1,000 (residential)	1-day oral (rat) , plasma, RBC, and brain ChEI
Short-Term Dermal	Dermal NOAEL 100 mg/kg/day	100 (occupational) 1,000 (residential)	21-day dermal (rabbit), RBC ChEI
Intermediate-Term Dermal	Dermal NOAEL 100 mg/kg/day	100 (occupational) 1,000 (residential)	21-day dermal (rabbit), RBC ChEI
Long-Term Dermal	A long-term exposure scenario is not expected based on the use patterns of trichlorfon.		
Inhalation	NOAEL 0.0127 mg/- L (3.45 mg/kg/day)	100 (occupational) 1,000 (residential)	21-day inhalation (rats), RBC ChEI
Cancer	Group E	NA	NA

## **SUMMARY OF USE PATTERN AND FORMULATIONS**

At this time products containing trichlorfon are intended for both homeowner and occupational uses. Trichlorfon is an organophosphate insecticide used on lawns, other turf, and ornamentals, as a crack and crevice treatment (non-residential), around building perimeters, as a surface spray in and around farm buildings (when animals are not present), as a mound treatment to control Texas Harvester ants, and as a freshwater pond/tank treatment.

## **Type of pesticide/target pests**

Products are labeled for outdoor turf, ornamental, and perimeter treatments to control a wide variety of lepidopteran larvae (caterpillars), white grubs, mole crickets, sod webworms, leaf miners, stink bugs, ants, cockroaches, earwigs, crickets, pillbugs, Nantucket pine tip moth, Zimmerman pine moth, armyworms, bagworms, climbing cutworms, cutworms, mound treatment for Harvester ants; and control of other nuisance pests. Indoors (i.e., in farm buildings), trichlorfon is applied to control flies, ants, cockroaches, earwigs, crickets, and pillbugs. Special local needs labels for Arkansas and California permit application to commercially operated freshwater ponds/tanks to control predaceous diving beetle, water scavenger beetle, water boatman backswimmer, water scorpions, and giant water bugs.

## **Formulation types and percent active ingredient**

Trichlorfon (dimethyl (2,2,2-trichloro-1-hydroxyethyl)) phosphonate is currently formulated as a:

- C technical product with 98% active ingredient,
- C soluble powder with 80% active ingredient (which may only be applied by commercial applicators),
- C granular products with 5% and 6.2% active ingredient.

Wettable powder formulations are used as surrogates for the soluble powder use .

## **Registered use sites**

### **Occupational-use sites**

The use on sod farms and the bait formulation use on residential lawns have been voluntarily canceled by the affected registrants. Also, the use of the bait in indoor domestic areas is prohibited unless prepackaged in child resistant bait stations. All food, feed and field crop registrations have been voluntarily canceled by the registrant; the process of amending all affected labels was complete on November 21, 1995. The registrant is not supporting the domestic use of the cattle treatment.

Trichlorfon has been registered for occupational-use on:

- C Terrestrial non-food crops: Agricultural uncultivated areas, commercial animal kennels and sleeping quarters, recreational area and ornamental lawns, golf course turf, outdoor commercial/institutional/industrial premises and equipment, commercial freshwater ponds/tanks, nonagricultural uncultivated areas and soils, ornamental and/or shade trees, ornamental herbaceous and non-flowering plants, ornamental woody shrubs and vines, paths and patios, outdoor refuse/solid waste sites.

- C Indoor non-food/non-feed: Greenhouses, agricultural/farm premises, cattle feedlots, dairy farm milk storage rooms/houses/sheds, dairy farm milking stalls/parlors, non-food contact areas of food processing plant premises, nonfood areas of eating establishments, food/grocery/marketing/ storage/distribution facility premise, household/domestic dwellings, indoor food handling areas, non-food contact meat processing plant premises, non-food contact areas of poultry processing plant equipment, indoor commercial storage/warehouses premises. [All of these sites have required, and will continue to require, label restrictions prohibiting contamination of food/feed or food/feed handling equipment and restricting use to areas inaccessible to animals.]

### **Non-occupational-use sites**

Potential residential and non-occupational use sites may include outdoor uses around household/domestic dwellings (i.e., paths and patios), perimeter treatment around dwellings, and application to residential lawns.

### **Application Rates**

- C Lawns/recreational turf: 1.1 lb ai/acre to 8.2 lb ai/acre; 0.00019 to 0.00005 lb ai/square foot; however, the 1.1 lb ai/acre appears only one granular label. All other labels (granular and soluble powder) indicate a low rate of 5.4 lb ai/acre.
- C Commercial ponds/aquatic tank: 1.4 and 0.64 lb ai/acre-foot of pond
- C Ornamentals: 0.01 to 0.015 lb ai/gallon
- C Livestock buildings/areas: 0.0002 lb ai/square foot
- C Harvester ant mounds: 0.013 to 0.025 lb ai/mound

### **Method of Application**

- C Turf: groundboom sprayers, low-pressure handwand (spot treatment) , backpack (spot treatment), and handgun sprayers, sprinkling can (spot treatment), push-type granular spreaders, and irrigation systems.
- C Ornamentals: groundboom sprayers (drench), low- and high-pressure handwand and backpack sprayers
- C Pond treatments: low pressure handwand
- C Outdoor perimeter treatments: soluble powders in water by watering can, through hand-held sprayers; dry baits can be “sprinkled” out of a cup or spoon or put onto cardboard or plastic or applied as a mound treatment for ants; bait mixed with water and “sprinkled” out of a cup or watering can,



- C In and around buildings: low pressure handwand and backpack sprayers, and granular treatment to cracks, crevices and wall voids.

**Timing:**

Product labels do not give specific timing of application of trichlorfon. The most likely scenario is when pests have reached intolerable or damaging populations. For turf and lawns, most labels indicate application can be made monthly beginning May or June. Two or three applications per week may be necessary for trichlorfon treatment to commercial ponds according to special local needs labels.

## **ASSESSMENT/CHARACTERIZATION**

### **Occupational Exposures and Risks**

#### **Handler Exposures & Risks**

EPA has determined that there are potential exposures to mixers, loaders, applicators, or other handlers during usual use-patterns associated with trichlorfon. Based on the use patterns, 11 major exposure scenarios were identified for trichlorfon:

#### **Handler Exposure Scenarios -- Data and Assumptions**

No chemical-specific handler exposure data were submitted in support of the reregistration of trichlorfon. Therefore, an exposure assessment for each scenario was developed, where appropriate data are available, using the *Pesticide Handlers Exposure Database (PHED) Version 1.1*.

PHED was designed by a task force consisting of representatives from the U.S. EPA, Health Canada, the California Department of Pesticide Regulation, and member companies of the American Crop Protection Association. PHED is a generic database containing measured exposure data for workers involved in the handling or application of pesticides in the field. The basic assumption underlying the system is that exposure to pesticide handlers can be calculated using the monitored data as exposure is primarily a function of the physical parameters of the handling and application process (e.g., packaging type, application method, and clothing scenario). PHED also contains algorithms that allow the user to complete surrogate task-based exposure assessments beginning with one of the four main data files contained in the system (i.e., mixer/loader, applicator, flagger, and mixer/loader/-applicator).

Users can select data from each major PHED file and construct exposure scenarios that are representative of the use of the chemical. However, to add consistency to the risk assessment process, the EPA in conjunction with the PHED task force has evaluated all data within the system and developed a surrogate exposure table that contains a series of standard unit exposure values for various occupational exposure scenarios (*PHED Surrogate Exposure Guide of May, 1997*). These standard unit exposure values are the basis for this assessment. The standard exposure values (i.e., the unit exposure values included in the exposure and risk assessment tables) are based on the “best fit” values

calculated by PHED. PHED calculates “best fit” exposure values by assessing the distributions of exposures for each body part included in datasets selected for the assessment (e.g., chest or forearm) and then calculates a composite exposure value representing the entire body. PHED categorizes distributions as normal, lognormal, or in an “other” category. Generally, most data contained in PHED are lognormally distributed or fall into the PHED “other” distribution category. If the distribution is lognormal, the geometric mean for the distribution is used in the calculation of the “best fit” exposure value. If the data are an “other” distribution, the median value of the dataset is used in the calculation of the “best fit” exposure value. As a result, the surrogate unit exposure values that serve as the basis for this assessment generally range from the geometric mean to the median of the selected dataset.

Occupational handler exposure assessments are completed by the EPA using a baseline exposure scenario and, if required, increasing levels of risk mitigation (PPE and engineering controls) to achieve an appropriate margin of exposure or cancer risk. The baseline clothing/PPE ensemble for occupational exposure scenarios is generally an individual wearing long pants, a long-sleeved shirt, no chemical-resistant gloves, and no respirator.

Table 3 summarizes the caveats and parameters specific to the surrogate data used for each scenario and corresponding exposure/risk assessment. These caveats include the source of the data and an assessment of the overall quality of the data. The assessment of data quality is based on the number of observations and the available quality control data. The quality control data are based on a grading criteria established by the PHED Task Force.

**Handler scenarios:** Eleven handler scenarios were assessed for occupational handlers: (1) mixing/loading soluble powders for groundboom and chemigation applications; (2) applying with groundboom equipment; (3) mixing/loading/applying with groundboom equipment for drench application; (4) mixing/loading/applying with high pressure handwand sprayer; (5) mixing/loading/-applying with handgun sprayer; (6) mixing/loading/applying with low-pressure handwand sprayer; (7) mixing/loading/applying with backpack sprayer; (8) loading/applying with push-type drop spreader; (9) mixing/loading/applying with sprinkling can; (10) loading/applying with shaker can; and (11) applying granulars by hand.

**Assumptions:** The following assumptions and factors were used in order to complete this exposure assessment:

- C Median body weight of an adult handler is 70 kg.
- C Average work day interval represents an 8 hour workday (e.g., the acres treated or volume of spray solution applied in a typical day).
- C Daily acres and volumes (as appropriate) to be treated in each scenario include:
  - Golf course turfgrass and chemigation treatments: 40 acres for occupational handlers; not applicable to residential handlers.
  - Residential and recreational turfgrass broadcast treatments: 5 acres for

- occupational handlers; and 0.5 acres for residential handlers
- Residential and recreational turfgrass perimeter/spot treatments: 100 sq ft for occupational handlers using a sprinkler can, and 1,000 ft<sup>2</sup> for hand-applied treatments, and 5 granule shaker cans for occupational handlers;
- Residential and recreational turfgrass ant mound treatments: 14 mounds for occupational handlers; and 5 mounds for residential handlers
- Narcissus drench treatment (groundboom): 1,000 gallons for occupational handlers; not applicable to residential handlers
- Ornamental treatments: 1,000 gallons high-pressure handwand, 40 gallons for low-pressure handwand and backpack for occupational handlers; not applicable to residential handlers
- Pond/aquatic tank treatments: large pond (volume = 15 acre-feet) and small pond (volume = 7.5 acre-feet) for occupational handlers; not applicable for residential handlers
- Buildings: 20,000 sq ft for occupational handlers; not applicable for residential handlers

C Calculations are completed at the maximum application rates for specific crops recommended by the available trichlorfon labels for the various use patterns.

**Table 3: Occupational Exposure Scenario Descriptions for the Use of Trichlorfon**

Exposure Scenario (Number)	Data Source	Standard Assumptions <sup>a</sup> (8-hr work day)	Comments <sup>b</sup>
Mixer/Loader Descriptors			
Mixing/Loading Soluble Powder Formulations (1)	PHED V1.1 (August, 1998)	40 acres for golf course turf application by groundboom or chemigation	<p><b>Baseline:</b> Hands, dermal, and inhalation = ABC grades. Hands = 7 replicates; Dermal = 22 to 45 replicates; and Inhalation = 44 replicates. Low confidence in hands and dermal data and medium confidence in inhalation data. No protection factor needed.</p> <p><b>PPE 1:</b> Hands = ABC grades and 24 replicates. Medium confidence in hands data. Baseline inhalation data are coupled with an 80% protection factor to account for the use of a dust/mist respirator.</p> <p><b>Engineering Controls:</b> Dermal = AB grades; hands and inhalation = all grades. Hands = 9 replicates; Dermal = 6 to 15 replicates; and Inhalation = 15 replicates. Low confidence in the hands, dermal and inhalation data. Engineering controls are based on water soluble packets.</p>
Applicator Descriptors			
Applying Sprays with a Groundboom Sprayer (2)	PHED V1.1 (August, 1998)	40 acres for turf application	<p><b>Baseline:</b> Hand, dermal, and inhalation = AB grades. Hands = 29 replicates, dermal = 23 to 42 replicates, and inhalation = 22 replicates. High confidence in hand, dermal, and inhalation data. No protection factor was needed to define the unit exposure value.</p>
Mixer/Loader/Applicator Descriptors			
Mixing/Loading/Applying with a Groundboom Sprayer (3)	PHED V1.1 (August, 1998)	1,000 gallons drench treatment	<p><b>Baseline:</b> Dermal and hands data = ABC grades, and inhalation = AB grade. Hands = 29 replicates, dermal = 17 to 67 replicates, and inhalation = 26 replicates. Medium confidence in hands and dermal data. High confidence in inhalation data. No protection factor was needed to define the unit exposure value.</p>
Mixing/Loading/Applying using High Pressure Handwand (4)	PHED V1.1 (August, 1998)	1,000 gallons for application to ornamentals	<p><b>Baseline:</b> Dermal = AB grades and 7-13 replication. Inhalation = A grades and 13 replicates. Low confidence in dermal and inhalation data. No data for hands.</p> <p><b>PPE 1:</b> Hands = C grades and 13 replication. Low confidence in hands data. Baseline dermal data used. The baseline inhalation data coupled with an 80% protection factor to account for the use of a dust/mist respirator.</p> <p><b>Engineering Controls:</b> Not feasible for this scenario.</p>
Mixing/Loading/Applying with a Handgun Sprayer (Low Pressure - High Volume) (5)	PHED V1.1 (August, 1998)	5 acres	<p><b>Baseline:</b> Inhalation = B grade with 14 replicates. Low confidence in inhalation data. No data for dermal or hand.</p> <p><b>PPE 1:</b> Dermal and hand data = C grade. Dermal = 0 to 14 replicates and hands = 14 replicates. Low confidence in hands and dermal data. Baseline inhalation data used.</p> <p><b>Engineering Controls:</b> Not feasible for this scenario.</p>

**Table 3: Occupational Exposure Scenario Descriptions for the Use of Trichlorfon (Continued)**

Exposure Scenario (Number)	Data Source	Standard Assumptions <sup>a</sup> (8-hr work day)	Comments <sup>b</sup>
Mixing/Loading/Applying Soluble Powders Using Low Pressure Hand Wand (6)	PHED V1.1 (August, 1998)	1,000 ft <sup>2</sup> for turfgrass spot treatment, 40 gallons for ornamentals, 20,000 ft <sup>2</sup> for livestock areas, and a pond with a surface area of 2.5 acres and a depth of 3 feet, and one pond with a surface area of 5 acres and a depth of 3 feet,	<p><b>Baseline:</b> Dermal and inhalation data are ABC grades. Dermal = 16 replicates and inhalation = 16 replicates. Low confidence in dermal, and medium confidence inhalation data. No protection factor was needed to define the unit exposure value.</p> <p><b>PPE 1:</b> Hand data = AB grades and medium confidence. Baseline dermal data are used. Baseline inhalation data coupled with an 80% protection factor to account for the use of a dust/mist respirator.</p> <p><b>PPE 2:</b> Hand data = AB grades and medium confidence. Baseline dermal data is coupled with a 50% protection factor to account for an additional layer of clothing. Baseline inhalation data coupled with an 80% protection factor to account for the use of a dust/-mist respirator.</p> <p><b>Engineering Controls:</b> Not feasible for this scenario.</p>
Mixing/Loading/Applying with a Backpack Sprayer (7)	PHED V1.1 (August, 1998))	1,000 ft <sup>2</sup> for turf spot treatments, 40 gallons for ornamentals and 20,000 ft <sup>2</sup> for livestock areas	<p><b>Baseline:</b> No data for dermal and hands. Inhalation = A grade. Inhalation = 11 replicates. Low confidence in inhalation data.</p> <p><b>PPE 1:</b> Dermal= AB grade and hands = C grade. Dermal = 9 to 11 replicates, and hands = 11 replicates. Low confidence in dermal and hands data. Baseline dermal data are used. Baseline inhalation data are used.</p> <p><b>PPE 2:</b> Dermal= AB grade and hands = C grade. Dermal = 9 to 11 replicates, and hands = 11 replicates. Low confidence in dermal and hands data. Dermal data is coupled with a 50% protection factor to account for an additional layer of clothing.</p> <p><b>Engineering Controls:</b> Not feasible for this scenario.</p>
Loading/Applying with a Push Type Lawn Spreader (8)	PHED V1.1 (August, 1998)	5 acres	<p><b>Baseline:</b> Hand and dermal = C grades, and inhalation = B grade. Hand = 15 replicates, dermal = 0-15 replicates, and inhalation = 15 replicates. Low confidence in hand and dermal data, and high confidence in inhalation data. No protection factor needed.</p> <p><b>PPE 1:</b> Baseline dermal data are used. Baseline hand data are coupled with a 90% protection factor to account for the use of chemical-resistant gloves. Baseline inhalation data are used.</p> <p><b>Engineering Controls:</b> Not feasible.</p>
Loading/Applying with a Watering Can (9)	Surrogate	100 ft <sup>2</sup>	<p><b>Used mixing/loading/applying with a hose end sprayer as a surrogate.</b></p> <p><b>Baseline:</b> Dermal data are C grade with 8 replicates; Hand data are E grade with 8 replicates; Inhalation is ABC grades with 8 replicates. Low confidence in hand and inhalation data and very low confidence in dermal data. Dermal data is based on total deposition data -- 50 % protection factor to account for use of single layer of clothing.</p>

**Table 3: Occupational Exposure Scenario Descriptions for the Use of Trichlorfon (Continued)**

Exposure Scenario (Number)	Data Source	Standard Assumptions <sup>a</sup> (8-hr work day)	Comments <sup>b</sup>
Loading/Applying/ Granular with Shaker Can (10)	Surrogate	5 cans	<b>Used loading/applying granulars by hand as a surrogate.</b>
Loading/Applying Granulars by Hand (11)	PHED V1.1 (August, 1998)	1,000 ft <sup>2</sup> for perimeter treatment and 14 Texas Harvester ant mounds	<b>Baseline:</b> Dermal and inhalation data are ABC grades. Dermal =16 replicates and inhalation =16 replicates. Low confidence in dermal data; medium confidence in inhalation data. A 90 percent protection factor was used to “back-calculate” a no glove scenario because exposure data for a no glove scenario is not available.

a Standard Assumptions based on an 8-hour work day as estimated by HED. BEAD data were not available.

b "Best Available" grades are defined HED SOP for meeting Series 875 Guidelines. Best available grades are assigned as follows: matrices with grades A and B data and a minimum of 15 replicates; if not available, then grades A, B and C data and a minimum of 15 replicates; if not available, then all data regardless of the quality and number of replicates. Data confidence are assigned as follows:

High = grades A and B and 15 or more replicates per body part

Medium = grades A, B, and C and 15 or more replicates per body part

Low = grades A, B, C, D and E or any combination of grades with less than 15 replicates

## Handler Exposure and Risk Estimates

Potential daily dermal dose was calculated using the following formula:

$$\text{Daily Dermal Dose} \left( \frac{\text{mg ai}}{\text{kg/day}} \right) = \text{Unit Exposure} \left( \frac{\text{mg ai}}{\text{lb ai}} \right) \times \text{Use Rate} \left( \frac{\text{lb ai}}{\text{A}} \right) \times \text{Daily Acres Treated} \left( \frac{\text{A}}{\text{day}} \right) \times \frac{1}{\text{Body Weight (kg)}}$$

The potential baseline inhalation dose was calculated using the following formula:

$$\text{Daily Inhalation Exposure} \left( \frac{\text{mg ai}}{\text{kg/day}} \right) = \text{Unit Exposure} \left( \frac{\text{mg ai}}{\text{lb ai}} \right) \times \text{Conversion Factor} \left( \frac{1 \text{ mg}}{1,000 \text{ Fg}} \right) \times \text{Use Rate} \left( \frac{\text{lb ai}}{\text{A}} \right) \times \text{Daily Acres Treated} \left( \frac{\text{A}}{\text{day}} \right) \times \frac{1}{\text{Body Weight (kg)}}$$

Potential total daily dose was calculated using the following formula:

$$\text{Daily Total Dose} \left( \frac{\text{mg ai}}{\text{kg/day}} \right) = \text{Daily Dermal Dose} \left( \frac{\text{mg ai}}{\text{kg/day}} \right) + \text{Daily Inhalation Dose} \left( \frac{\text{mg ai}}{\text{kg/day}} \right)$$

The MOEs are calculated using the following formula:

$$\text{MOE} = \frac{\text{NOAEL} \left( \frac{\text{mg}}{\text{kg day}} \right)}{\text{Daily Dose} \left( \frac{\text{mg}}{\text{kg day}} \right)}$$

## **Summary of Risk Concerns for Handlers**

Several tables present risk assessment calculations for the occupational handling of trichlorfon. Table 4 presents the short- and intermediate-term dermal and inhalation risks at baseline. Table 5 presents the short- and intermediate-term dermal and inhalation risks when using additional personal protective equipment. Table 6 presents short- and intermediate-term dermal and inhalation risks when using engineering controls.

The risk assessment indicates that for occupational handlers risks from combined dermal and inhalation exposures are below the level of concern (i.e., the MOE >100) at **baseline attire** for the following scenarios:

- C (2) applying spray with a groundboom sprayer;

- C (3) mixing/loading/applying with groundboom equipment for drench application;
- C (8) loading/applying with push-type spreader at the low rate of 1.1 lb ai/acre;
- C (9) mixing/loading/applying with sprinkling can;
- C (10) loading/applying with shaker can; and
- C (11) applying granulars by hand.

The risk assessment indicates that for occupational handlers risks from combined dermal and inhalation exposures are below the level of concern (i.e., the MOE >100) at ***additional personal protective equipment*** for the following scenarios:

- C (4) mixing/loading/applying with high pressure handwand sprayer with chemical-resistant gloves and a dust/mist respirators in addition to baseline attire;
- C (5) mixing/loading/applying with handgun sprayer with chemical-resistant gloves in addition to baseline attire;
- C (6) mixing/loading/applying with low-pressure handwand sprayer in and around buildings with chemical-resistant gloves and a dust/mist respirators in addition to baseline attire, to ornamentals with chemical resistant gloves in addition to baseline attire, as a spot treatment to turfgrass using chemical resistant gloves in addition to baseline attire, and to 7.5 acre-foot commercial ponds at the application rate of 0.64 lb ai/acre-foot of pond;
- C (7) mixing/loading/applying with backpack sprayer to ornamentals, as a turfgrass spot treatment, and in and around buildings with chemical-resistant gloves in addition to baseline attire;
- C (8) loading/applying with push-type spreader at the high application rate of 8.1 lb ai/A with chemical-resistant gloves in addition to baseline attire;

The risk assessment indicates that for occupational handlers risks from combined dermal and inhalation exposures are below the level of concern (i.e., the MOE >100) at ***engineering controls*** for the following scenario: (1) mixing/loading soluble powders for groundboom and chemigation applications.

The risk assessment indicates that for occupational handlers risks from combined dermal and inhalation exposures exceeds the level of concern (i.e., the MOE <100) at ***maximum risk mitigation*** (i.e., maximum PPE, since engineering controls are not feasible) for the following scenarios:

- C (6) mixing/loading/applying with low-pressure handwand sprayer to 15 acre-foot commercial ponds at the application rate of 1.4 and 0.64 lb ai/acre-foot of pond and to 7.5 acre-foot commercial ponds at the application rate of 0.64 lb ai/acre-foot of pond;



### **Handler Data Quality and Confidence in Assessment**

Several issues must be considered when interpreting the occupational exposure and risk assessment. These include:

- C Several handler assessments were completed using “low quality” PHED data due to the lack of a more acceptable dataset.
- C Several generic protection factors were used to calculate handler exposures. These protection factors have not been completely evaluated and accepted by HED.

**Table 4. Baseline Occupational Short-term and Intermediate-term Risks from Trichlorfon**

Exposure Scenario (Scen. #)	Baseline Dermal Unit Exposure (mg/lb ai) <sup>a</sup>	Baseline Inhalation Unit Exposure (µg/lb ai) <sup>b</sup>	Crop Type/- Use <sup>c</sup>	Acres Treated or Amount Handled per Day <sup>d</sup>	Application Rate (lb ai/acre) <sup>e</sup>	Dermal		Inhalation		Combined	
						Daily Dose <sup>f</sup> (mg/kg/day)	MOE <sup>g</sup> (100 needed)	Daily Dose <sup>h</sup> (mg/kg/day)	MOE <sup>i</sup> (100 needed)	Daily Dose <sup>j</sup> (mg/kg/day)	MOE <sup>k</sup> (100 needed)
Mixer Loader Exposures											
Mixing/Loading Soluble Powder for Groundboom and Chemigation Application (1)	3.7	43	turf	40 acres	8.2 lb ai/acre	17	5.8	0.20	17	18	4.3
Applicator Exposures											
Applying Spray with a Groundboom (2)	0.014	0.74	turf	40 acres	8.2 lb ai/acre	0.066	1,500	0.0035	990	0.069	600
Mixer/Loader/Applicator Exposures											
Mixing/Loading/Applying with a Groundboom as a Drench (3)	0.37	1.3	narcissus	1,000 gallons	0.01 lb ai/-gallon	0.053	1,900	0.00019	19,000	0.053	1,700
Mixing/Loading/Applying with a High Pressure Handwand Sprayer (4)	No Data	120	ornamentals	1,000 gallons	0.015 lb ai/-gallon	No Data	No Data	0.026	130	No Data	No Data
Mixing/Loading/Applying with a Handgun Sprayer (5)	No Data	1.4	turf	5 acres	8.2 lb ai/acre	No Data	No Data	0.00082	4,200	No Data	No Data
Mixing/Loading/Applying with a Low Pressure Handwand (soluble powder formulation) (6)	No Data	1,100	turf (spot treatment)	1,000 ft <sup>2</sup>	0.00019 lb ai/ft <sup>2</sup>	No Data	No Data	0.0030	1,200	No Data	No Data
			ornamentals	40 gallons	0.015 lb ai/-gallon	No Data	No Data	0.0094	370	No Data	No Data
			livestock areas	20,000 ft <sup>2</sup>	0.0002 lb ai/ft <sup>2</sup>	No Data	No Data	0.063	55	No Data	No Data
			commercial ponds/tanks	1 pond (5.0 acres surface area * 3 ft deep)	1.4 lb ai/acre-ft	No Data	No Data	0.33	10	No Data	No Data
					0.64 lb ai/acre-ft	No Data	No Data	0.15	23	No Data	No Data
				1 pond (2.5 acres surface area * 3 ft deep)	1.4 lb ai/acre-ft	No Data	No Data	0.17	21	No Data	No Data
					0.64 lb ai/acre-ft	No Data	No Data	0.075	46	No Data	No Data

**Table 4. Baseline Occupational Short-term and Intermediate-term Risks to Trichlorfon (continued)**

Exposure Scenario (Scen. #)	Baseline Dermal Unit Exposure (mg/lb ai) <sup>a</sup>	Baseline Inhalation Unit Exposure (µg/lb ai) <sup>b</sup>	Crop Type/-Use <sup>c</sup>	Acres Treated or Amount Handled per Day <sup>d</sup>	Application Rate (lb ai/acre) <sup>e</sup>	Dermal		Inhalation		Combined	
						Daily Dose <sup>f</sup> (mg/kg/day)	MOE <sup>g</sup> (100 needed)	Daily Dose <sup>h</sup> (mg/kg/day)	MOE <sup>i</sup> (100 needed)	Daily Dose <sup>j</sup> (mg/kg/day)	MOE <sup>k</sup> (100 needed)
Mixing/Loading/Applying with a Backpack Sprayer (7)	No Data	30	turf (spot treatment)	1,000 ft <sup>2</sup>	0.00019 lb ai/ft <sup>2</sup>	No Data	No Data	0.000081	42,000	No Data	No Data
			ornamentals	40 gallons	0.015 lb ai/-gallon	No Data	No Data	0.00026	13,000	No Data	No Data
			livestock areas	20,000 ft <sup>2</sup>	0.0002 lb ai/ft <sup>2</sup>	No Data	No Data	0.0017	2,000	No Data	No Data
Loading/Applying Granulars with a Push Type Spreader (8)	2.9	6.3	turf	5 acres	8.1 lb ai/acre	1.7	60	0.0036	950	1.7	56
					1.1 lb ai/acre	0.23	440	0.00050	7,000	0.23	410
Loading/Applying with a Sprinkling Can (9)	31 (surrogate)	9.5 (surrogate)	turf spot treatment	100 ft <sup>2</sup>	0.00019 lb ai/-ft <sup>2</sup>	0.0084	12,000	2.6E-06	1.3E+06	0.0084	12,000
Mixing/Loading/Applying with a Shaker Can (10)	100 (surrogate)	470 (surrogate)	perimeter	5 cans	0.062 lb ai/can	0.44	230	0.0021	1,700	0.44	200
Applying Granulars by Hand (11)	100	470	perimeter	1,000 ft <sup>2</sup>	0.000050 lb ai/ft <sup>2</sup>	0.071	1,400	0.00034	10,000	0.072	1,200
					0.0000125 lb ai/ft <sup>2</sup>	0.018	5,600	0.000084	41,000	0.018	4,900
			Texas Harvester Ant Mounds	14 mounds	0.025 lb ai/-mound	0.50	200	0.0024	1,500	0.50	180
					0.013 lb ai/-mound	0.26	380	0.0012	2,800	0.26	340

**Footnotes:**

- a Baseline dermal unit exposure represents long pants, long sleeved shirt, no gloves, open mixing/loading, open cab/tractor. Values from PHED Surrogate Exposure Guide - Draft August, 1998.
- b Baseline inhalation unit exposure represents no respirator. PHED Surrogate Exposure Guide - Draft August, 1998.
- c The crop type/ use column provides a general description of where trichlorfon is applied using the specific application methods.
- d Amount handled per day values are based on EPA estimates. The amount handled during treatment to livestock buildings is based on label #3125-184 instructions which specify mixing 5 pounds of DYLOX 80 in 40 gallons of water and spraying 1 gallon per 500 ft (40 \* 500 ft<sup>2</sup> = 20,000 ft<sup>2</sup>). Amount handled for a commercially operated freshwater pond is based on a pond with a surface area of 5 acres and a depth of 3 feet with a use rate of 0.25 (Arkansas 3125-184) and 0.50 (California 3125-184) ppm active ingredient. For example, Arkansas label 3125-184 specifies treatment of 0.8 lb DYLOX 80 per acre foot of pond. For a pond 3 feet deep with a surface area of 2.5 acres the pond volume is 5 \* 3 = 15 acre-feet. Therefore 7.5 acre-feet \* 0.8 lb / acre-foot \* 0.8 (% active ingredient in DYLOX 80) = 0.64 lb ai/acre-foot of pond. California label 3125-184 specifies a use rate of 1.7 lb per acre foot of pond volume. Therefore 1.7 lb / acre-foot \* 0.8 (% active ingredient in DYLOX 80) = 1.4 lb ai/acre-foot of pond. A pond with a surface area of 2.5 acres and a depth of 3 feet would therefore represent 7.5 acre-feet.
- Application rates are the maximum application rates presented on EPA registered labels. Rates are taken from the following labels:  
 Scenarios 1a, 2, 3,5,6,7,9: 3125-184 (range of application rates provided as a range finder for scenario 7); Scenario 4: 3125-449; Scenarios 8,10: 3125-400 (range of application rates provided as a range finder for scenario 8); and

**Table 4. Baseline Occupational Short-term and Intermediate-term Risks to Trichlorfon (continued)**

Scenario 11: 655-790, 791.	
f	Dermal daily dose (mg/kg/day) = daily unit exposure (mg/lb ai) x application rate (lb ai/acre) x amount handled per day (acres) / body weight (70 kg).
g	Dermal MOE = NOAEL (100 mg/kg) / daily dose (mg/kg/day).
h	Inhalation daily dose (mg/kg/day) = inhalation unit exposure (Fg/lb ai) x application rate (lb ai/acre) x amount handled per day (acres) x conversion factor (1 mg/1,000 Fg) / body weight (70 kg).
I	Inhalation MOE = NOAEL (3.45 mg/kg/day) / daily dose (mg/kg/day).
j	Total dermal dose = daily dermal dose (mg/kg/day) + daily inhalation dose (mg/kg/day)
k	Total MOE = 1 / [(1 / dermal MOE) + (1 / inhalation MOE)].

**Table 5. Occupational Short-term and Intermediate-term Risks from Trichlorfon with PPE Mitigation**

Exposure Scenario (Scen. #)	PPE Dermal Unit Exposure (mg/lb ai) <sup>a</sup>	PPE Inhalation Unit Exposure (µg/lb ai) <sup>b</sup>	Crop Type/-Use <sup>c</sup>	Acres Treated or Amount Handled per Day <sup>d</sup>	Application Rate (lb ai/-acre) <sup>e</sup>	PPE Dermal		PPE Inhalation		Combined
						Daily Dose <sup>f</sup> (mg/kg/day)	MOE <sup>g</sup> (100 needed)	Daily Dose <sup>h</sup> (mg/kg/day)	MOE <sup>i</sup> (100 needed)	MOE <sup>j</sup> (100 needed)
Mixer Loader Exposures										
Mixing/Loading Soluble Powder for Groundboom and Chemigation Application (1)	0.17 (PPE 1)	8.6	turf	40 acres	8.2 lb ai/acre	0.80	130	0.040	86	51 (PPE 1, resp)
Applicator Exposures										
Applying Spray with a Groundboom (2)	NA	NA	turf	40 acres	8.2 lb ai/acre	NA	NA	NA	NA	NA
Mixer/Loader/Applicator Exposures										
Mixing/Loading/Applying with a Groundboom as a Drench (3)	NA	NA	narcissus	1,000 gallons	0.01 lb ai/-gallon	NA	NA	NA	NA	NA
Mixing/Loading/Applying with a High Pressure Handwand Sprayer (4)	2.5 (PPE 1)	24	ornamentals	1,000 gallons	0.015 lb ai/-gallon	0.54 (PPE 1)	190	0.0051	670	150 (PPE 1, resp)
Mixing/Loading/Applying with a Handgun Sprayer (5)	0.34 (PPE 1)	NA	turf	5 acres	8.2 lb ai/acre	0.20 (PPE 1)	500	NA	NA	450 (PPE 1, baseline)
Mixing/Loading/Applying with a Low Pressure Handwand (soluble powder formulation) (6)	8.6 (PPE 1) 6.2 (PPE 2)	220	turf spot treatment	1,000 ft <sup>2</sup>	0.00019 lb ai/ft <sup>2</sup>	0.023 (PPE 1)	4,300	NA	NA	910 (PPE 1, baseline)
			ornamentals	40 gallons	0.015 lb ai/-gallon	0.074 (PPE 1)	1,400	NA	NA	290 (PPE 1, baseline)
			livestock areas	20,000 ft <sup>2</sup>	0.0002 lb ai/ft <sup>2</sup>	0.49 (PPE 1)	200	0.013	270	120 (PPE 1, resp)
			commercial ponds/tanks	1 pond (5.0 acres surface area * 3 ft deep)	1.4 lb ai/acre-ft	1.9 (PPE 2)	54	0.066	52	27 (PPE 2, resp)
					0.64 lb ai/acre-ft	0.85 (PPE 2)	120	0.030	110	58 (PPE 2, resp)
				1 pond (2.5 acres surface area * 3 ft deep)	1.4 lb ai/acre-ft	0.93 (PPE 2)	110	0.033	100	53 (PPE 2, resp)
			0.64 lb ai/acre-ft		0.43 (PPE 2)	240	0.015	230	120 (PPE 2, resp)	

Table 5. Occupational Short-term and Intermediate-term Risks to Trichlorfon with PPE Mitigation (continued)

Exposure Scenario (Scen. #)	PPE Dermal Unit Exposure (mg/lb ai) <sup>a</sup>	PPE Inhalation Unit Exposure (µg/lb ai) <sup>b</sup>	Crop Type/-Use <sup>c</sup>	Acres Treated or Amount Handled per Day <sup>d</sup>	Application Rate (lb ai/-acre) <sup>e</sup>	PPE Dermal		PPE Inhalation		Combined
						Daily Dose <sup>f</sup> (mg/kg/day)	MOE <sup>g</sup> (100 needed)	Daily Dose <sup>h</sup> (mg/kg/day)	MOE <sup>i</sup> (100 needed)	MOE <sup>j</sup> (100 needed)
Mixing/Loading/Applying with a Backpack Sprayer (7)	2.5 (PPE 1) 1.6 (PPE 2)	NA	turf spot treatment	1,000 ft <sup>2</sup>	0.00019 lb ai/ft <sup>2</sup>	0.0068 (PPE 1)	15,000	NA	NA	11,000 (PPE 1, baseline)
			ornamentals	40 gallons	0.015 lb ai/-gallon	0.021 (PPE 1)	4,700	NA	NA	3,500 (PPE 1, baseline)
			livestock areas	20,000 ft <sup>2</sup>	0.0002 lb ai/ft <sup>2</sup>	0.14 (PPE 1)	700	NA	NA	520 (PPE 1, baseline)
Loading/Applying Granulars with a Push Type Spreader (8)	1.3 (PPE 1)	NA	turf	5 acres	8.1 lb ai/acre	0.75 (PPE 1)	130	NA	NA	120 (PPE 1, baseline)
					1.1 lb ai/acre	NA	NA	NA	NA	NA
Mixing/Loading/Applying with a Sprinkling Can (9)	NA	NA	turf spot treatment	100 ft <sup>2</sup>	0.00019 lb ai/-ft <sup>2</sup>	NA	NA	NA	NA	NA
Loading/Applying with a Shaker Can (10)	NA	NA	perimeter	5 cans	0.062 lb ai/can	NA	NA	NA	NA	NA
Applying Granulars by Hand (11)	NA	NA	perimeter	1,000 ft <sup>2</sup>	0.000050 lb ai/ft <sup>2</sup>	NA	NA	NA	NA	NA
					0.0000125 lb ai/ft <sup>2</sup>	NA	NA	NA	NA	NA
			Texas Harvester Ant Mounds	14 mounds	0.025 lb ai/-mound	NA	NA	NA	NA	NA
					0.013 lb ai/-mound	NA	NA	NA	NA	NA

NA: indicates acceptable MOEs at baseline

**Footnotes:**

a PPE 1 dermal unit exposure represents use of chemical resistant gloves along with long pants, long sleeved shirt, open mixing/loading, open cab/tractor. PPE 2 represents use of gloves plus a double layer of clothing. Values from PHED Surrogate Exposure Guide - Draft August, 1998.

b PPE inhalation unit exposure represents use of dust mist mask (80% protection factor applied to baseline unit exposure).

c The crop type/use column provides a general description of where trichlorfon is applied using the specific application methods.

d Amount handled per day values are based on EPA estimates. The amount handled during treatment to livestock buildings is based on label #3125-184 instructions which specify mixing 5 pound of DYLOX 80 in 40 gallons of water and spraying 1 gallon per 500 ft<sup>2</sup> (40 \* 500 ft<sup>2</sup> = 20,000 ft<sup>2</sup>). Amount handled for a commercially operated freshwater pond is based on a pond with a surface area of 5 acres and a depth of 3 feet with a use rate of 0.25 (Arkansas 3125-184) and 0.50 (California 3125-184) ppm active ingredient. For example, Arkansas label 3125-184 specifies treatment of 0.8 lb DYLOX 80 per acre foot of pond. For a pond 3 feet deep with a surface area of 2.5 acres the pond volume is 5 \* 3 = 15 acre-feet. Therefore 7.5 acre-feet \* 0.8 lb / acre-foot \* 0.8 (% active ingredient in DYLOX 80) = 0.64 lb ai/acre-foot of pond. California label 3125-184 specifies a use rate of 1.7 lb per acre foot of pond volume. Therefore 1.7 lb / acre-foot \* 0.8 (% active ingredient in DYLOX 80) = 1.4 lb ai/acre-foot of pond. A pond with a

- surface area of 2.5 acres and a depth of 3 feet would therefore represent 7.5 acre-feet.
- e Application rates are the maximum application rates presented on EPA registered labels. Rates are taken from the following labels: Scenarios 1a, 2, 3,5,6,7,9: 3125-184; Scenario 4: 3125-449; Scenarios 8,10: 3125-400 (range of application rates provided as a range finder for scenarios 8 and 9); and Scenario 11: 655-790, 791.
- f Dermal daily dose (mg/kg/day) = daily unit exposure (mg/lb ai) x application rate (lb ai/acre) x amount handled per day (acres) / body weight (70 kg).
- g Dermal MOE = NOAEL (100 mg/kg) / daily dose (mg/kg/day). MOE of \$ 100 is acceptable
- h Inhalation daily dose (mg/kg/day) = inhalation unit exposure (Fg/lb ai) x application rate (lb ai/acre) x amount handled per day (acres) x conversion factor (1 mg/1,000 Fg) / body weight (70 kg).
- I Inhalation MOE = NOAEL (3.45 mg/kg/day) / daily dose (mg/kg/day). MOE of \$ 100 is acceptable
- j Combined (Total) MOE = 1 / [(1 / dermal MOE) + (1 / inhalation MOE)]. MOE \$ 100 is acceptable. PPE 1 = addition of gloves to baseline, PPE 2 = addition of second layer of clothes and gloves, resp = addition of dust mist mask.

**Table 6. Occupational Short-term and Intermediate-term Risks from Trichlorfon with Engineering Control Mitigation**

Exposure Scenario (Scen. #)	Eng. Cont. Dermal Unit Exposure (mg/lb ai) <sup>a</sup>	Eng. Cont. Inhalation Unit Exposure (µg/lb ai) <sup>b</sup>	Crop Type/- Use <sup>c</sup>	Acres Treated or Amount Handled per Day <sup>d</sup>	Application Rate (lb ai/- acre) <sup>e</sup>	Engineering Controls - Dermal		Engineering Controls - Inhalation		Engineering Controls Combined	
						Daily Dose <sup>f</sup> (mg/kg/day)	MOE <sup>g</sup> (100 needed)	Daily Dose <sup>h</sup> (mg/kg/day)	MOE <sup>i</sup> (100 needed)	Daily Dose <sup>j</sup> (mg/kg/day)	MOE <sup>k</sup> (100 needed)
Mixer Loader Exposures											
Mixing/Loading Soluble Powder for Groundboom and Chemigation Application (1)	0.0098	0.24	turf	40 acres	8.2 lb ai/acre	0.046	2,200	0.0011	3,100	0.047	1,300
Applicator Exposures											
Applying Spray with a Groundboom (2)	NA	NA	turf	40 acres	8.2 lb ai/acre	NA	NA	NA	NA	NA	NA
Mixer/Loader/Applicator Exposures											
Mixing/Loading/Applying with a Groundboom as a Drench (3)	NA	NA	narcissus	1,000 gallons	0.01 lb ai/-gallon	NA	NA	NA	NA	NA	NA
Mixing/Loading/Applying with a High Pressure Handwand Sprayer (4)	NF	NF	ornamentals	1,000 gallons	0.015 lb ai/-gallon	NF	NF	NF	NF	NF	NF
Mixing/Loading/Applying with a Handgun Sprayer (5)	NF	NF	turf	5 acres	8.2 lb ai/acre	NF	NF	NF	NF	NF	NF
Mixing/Loading/Applying with a Low Pressure Handwand (6)	NF	NF	turf	1,000 ft <sup>2</sup>	0.00019 lb ai/ft <sup>2</sup>	NF	NF	NF	NF	NF	NF
			ornamentals	40 gallons	0.015 lb ai/-gallon	NF	NF	NF	NF	NF	NF
			livestock areas	20,000 ft <sup>2</sup>	0.0002 lb ai/-ft	NF	NF	NF	NF	NF	NF
			commercial ponds/tanks	1 pond SA 5 acres depth 3 ft	20.4 lb ai/pond	NF	NF	NF	NF	NF	NF
					9.6 lb ai/pond	NF	NF	NF	NF	NF	NF
Mixing/Loading/Applying with a Backpack Sprayer (7)	NF	NF	turf	1,000 ft <sup>2</sup>	0.00019 lb ai/ft <sup>2</sup>	NF	NF	NF	NF	NF	NF
			ornamentals	40 gallons	0.015 lb ai/-gallon	NF	NF	NF	NF	NF	NF



**Table 6. Occupational Short-term and Intermediate-term Risks to Trichlorfon when using Engineering Control Mitigation (continued)**

Exposure Scenario (Scen. #)	Eng. Cont. Dermal Unit Exposure (mg/lb ai) <sup>a</sup>	Eng. Cont. Inhalation Unit Exposure (µg/lb ai) <sup>b</sup>	Crop Type/-Use <sup>c</sup>	Acres Treated or Amount Handled per Day <sup>d</sup>	Engineering Controls - Dermal			Engineering Controls - Inhalation		Engineering Controls Combined	
					Application Rate (lb ai/-acre) <sup>e</sup>	Daily Dose <sup>f</sup> (mg/kg/day)	MOE <sup>g</sup> (100 needed)	Daily Dose <sup>h</sup> (mg/kg/day)	MOE <sup>i</sup> (100 needed)	Daily Dose <sup>j</sup> (mg/kg/day)	MOE <sup>k</sup> (100 needed)
			livestock areas	20,000 ft <sup>2</sup>	0.0002 lb ai/-ft	NF	NF	NF	NF	NF	NF
Loading/Applying Granulars with a Push Type Spreader (8)	NF	NF	turf	5 acres	8.1 lb ai/acre	NF	NF	NF	NF	NF	NF
					1.1 lb ai/acre	NF	NF	NF	NF	NF	NF
Mixing/Loading/Applying with a Sprinkling Can (9)	NF	NF	turf spot treatment	100 ft <sup>2</sup>	0.00019 lb ai/ft <sup>2</sup>	NF	NF	NF	NF	NF	NF
Applying with a Shaker Can (10)	NF	NF	perimeter	5 cans	0.062 lb ai/-can	NF	NF	NF	NF	NF	NF
Applying Granulars by Hand (11)	NF	NF	perimeter	1,000 ft <sup>2</sup>	0.000050 lb ai/ft <sup>2</sup>	NF	NF	NF	NF	NF	NF
					0.0000125 lb ai/ft <sup>2</sup>	NF	NF	NF	NF	NF	NF
			Texas Harvester Ant Mounds	14 mounds	0.025 lb ai/-mound	NF	NF	NF	NF	NF	NF
					0.013 lb ai/-mound	NF	NF	NF	NF	NF	NF

**NA:** indicates acceptable MOEs at baseline or with PPE mitigation

**NF:** no engineering controls are available for this scenario

**Footnotes:**

a, b Engineering control mitigation (dermal and inhalation exposure) for scenario 1a includes closed mixing and loading. Values from PHED Surrogate Exposure Guide - Draft August, 1998.

c The crop type/ use column provides a general description of where trichlorfon is applied using the specific application methods.

d Amount handled per day values are based on EPA estimates. The amount handled during treatment to livestock buildings is based on label #3125-184 instructions which specify mixing 5 pound of DYLOX 80 in 40 gallons of water and spraying 1 gallon per 500 ft<sup>2</sup> (40 \* 500 ft<sup>2</sup> = 20,000 ft<sup>2</sup>). Amount handled for a commercially operated freshwater pond is based on a pond with a surface area of 5 acres and a depth of 3 feet with a use rate of 0.25 (Arkansas 3125-184) and 0.50 (California 3125-184) ppm active ingredient. For example, Arkansas label 3125-184 specifies treatment of 0.8 lb DYLOX 80 per acre foot of pond. For a pond 3 feet deep with a surface area of 2.5 acres the pond volume is 5 \* 3 = 15 acre-feet. Therefore 7.5 acre-feet \* 0.8 lb / acre-foot \* 0.8 (% active ingredient in DYLOX 80) = 0.64 lb ai/acre-foot of pond. California label 3125-184 specifies a use rate of 1.7 lb per acre foot of pond volume. Therefore 1.7 lb / acre-foot \* 0.8 (% active ingredient in DYLOX 80) = 1.4 lb ai/acre-foot of pond. A pond with a surface area of 2.5 acres and a depth of 3 feet would therefore represent 7.5 acre-feet.

e Application rates are the maximum application rates presented on EPA registered labels. Rates are taken from the following labels: Scenarios 1a, 2, 3,5,6,7,9: 3125-184 (range of application rates provided as a range finder for scenarios 7); Scenario 4: 3125-449; Scenarios 8,10: 3125-400 (range of application rates provided as a range finder for scenario 8); and Scenario 11: 655-790, 791.

f Dermal daily dose (mg/kg/day) = daily unit exposure (mg/lb ai) x application rate (lb ai/acre) x amount handled per day (acres) / body weight (70 kg).

g Dermal MOE = NOAEL (100 mg/kg) / daily dose (mg/kg/day). MOE of \$ 100 is acceptable.

h Inhalation daily dose (mg/kg/day) = inhalation unit exposure (Fg/lb ai) x application rate (lb ai/acre) x amount handled per day (acres) x conversion factor (1 mg/1,000 Fg) / body weight (70 kg).

i Inhalation MOE = NOAEL (3.45 mg/kg/day) / daily dose (mg/kg/day). MOE of \$ 100 is acceptable.

j Total dermal dose = daily dermal dose (mg/kg/day) + daily inhalation dose (mg/kg/day)

k Total MOE = 1 / [(1 / dermal MOE) + (1 / inhalation MOE)]. MOE of \$ 100 is acceptable.

## **Post-Application Exposures and Risks**

### **Occupational Postapplication Exposure Scenarios**

No chemical-specific postapplication human reentry or transferable residue data were submitted in support of the reregistration of trichlorfon. Therefore, a surrogate postapplication exposure assessment was conducted to determine potential risks for the representative scenarios. EPA has determined that there are potential postapplication exposures to occupational workers in the following scenarios:

- mowing/maintaining golf course turfgrass; and
- cutting, harvesting, transplanting, pruning, balling/burlapping, irrigating, and sorting/packing nursery-grown ornamentals

Table 7 presents the surrogate postapplication exposure and risk assessment for occupational workers.

### **Assumptions Used in Postapplication Exposure Calculations**

The assumptions used in the calculations for occupational postapplication risks include:

- The dislodgeable foliar residue values are assumed to be 20 percent of the application rate at day 0 with a 10 percent daily dissipation rate for ornamental applications, and 5 percent of the application rate at day 0 for turfgrass application (the 5 percent rate for turfgrass is the high end of the values observed in Hurto and Prinster, 1993, Goh et al., 1986, and Cowell et al., 1993, additionally this value is consistent with proprietary data submissions);
- Transfer coefficients ( $T_c$ ) are assumed to be:
  - 1,000  $\text{cm}^2/\text{hour}$  for mowing/maintaining golf course turf
  - 10,000  $\text{cm}^2/\text{hour}$  for cutting, harvesting, transplanting, pruning, balling/burlapping ornamentals
  - 4,000  $\text{cm}^2/\text{hour}$  for irrigating ornamentals
  - 2,500  $\text{cm}^2/\text{hour}$  for sorting and packing ornamentals;
- Daily exposure is assumed to occur for 8 hours per day; and
- The median body weight of 70 kg is used, representing a typical adult.

## Postapplication Exposure and Risk Estimates

The postapplication occupational risks from trichlorfon has been assessed using surrogate regression data. The DFR values are derived from the application rate assuming an estimated 20 percent of the rate applied as initial dislodge able residues for the ornamental assessment and 5 percent for turfgrass application, and an estimated 10 percent dissipation rate per day. The equations used for the calculations in Table 7 are presented below.

Dislodge able foliar residues (DFRs) were calculated as follows:

$$DFR \left( \frac{Fg}{cm^2} \right) = AR \left( \frac{lb\ ai}{A} \right) \times CF \left( \frac{Fg/cm^2}{lb\ ai/A} \right) \times F \times (1 - DR)^t$$

Where:

- AR = application rate
- CF = conversion factor is 11.2 lb per cm<sup>2</sup>/lb ai per acre
- F = fraction retained on foliage
- DR = daily dissipation rate (10 percent per day)
- t = days after treatment

Daily Doses were calculated as follows:

$$Dose\ (mg/kg/d) = \frac{(DFR\ (Fg/cm^2) \times Tc\ (cm^2/hr) \times CF \left( \frac{1\ mg}{1,000\ Fg} \right) \times Abs \times ED\ (hrs/day))}{BW}$$

Where:

- DFR = daily DFR, as calculated above for the assumed average reentry day
- Tc = transfer coefficient;
- CF = conversion factor (i.e., 1 mg/1,000 Fg)
- Abs = dermal absorption is 100 %, since a dermal endpoint is used
- ED = exposure duration; 8 hours worked per day
- BW = body weight (70 kg)

MOEs were calculated as follows:

$$MOE = \frac{NOAEL\ (mg/kg/day)}{Dose\ (mg/kg/day)}$$

Where:

- NOAEL = 100 mg/kg/day

Dose = calculated absorbed dermal dose

Table 7 presents the MOEs for the four scenarios identified with concern for potential postapplication occupational exposure.

**Table 7. Trichlorfon Surrogate Occupational Postapplication Assessment for Treatment to Ornamentals and Golf Course Turf**

Crop	Application Rate	DAT <sup>a</sup>	DFR (Fg/cm <sup>2</sup> ) <sup>b</sup>	Mow/Maintain Transfer coefficient =1,000 cm <sup>2</sup> /hr		Cut, harvest, transplant, prune, balling Transfer coefficient = 10,000 cm <sup>2</sup> /hr		Irrigate Transfer coefficient = 4,000 cm <sup>2</sup> /hr		Sort/pack Transfer coefficient = 2,500 cm <sup>2</sup> /hr	
				Dermal Dose (mg/kg/day)	MOE	Dermal Dose (mg/kg/day)	MOE	Dermal Dose (mg/kg/day)	MOE	Dermal Dose (mg/kg/day)	MOE
Golf Course Turf	8.1 lb ai/acre	0	4.5	0.52	190	-	-	-	-	-	-
Ornamentals	3 lb ai/acre (0.015 lb ai/gal * 200 gal/acre)	0	6.7	-	-	7.7	13	3.1	33	1.9	52
		7	3.2	-	-	3.7	27	1.5	68	0.9	109
		11	2.1	-	-	2.4	42	0.97	104	-	-
		20	0.82	-	-	0.93	107	-	-	-	-
Ornamentals	6 lb ai/acre (0.015 lb ai/gal * 400 gal/acre)	0	13	-	-	15	6.5	6.1	16	3.8	26
		13	3.4	-	-	3.9	26	1.6	64	1.0	102
		18	2.0	-	-	2.3	43	0.92	108	-	-
		26	0.87	-	-	0.99	101	-	-	-	-

**Footnotes:-**

- a DAT is "days after treatment."
- b DFR = Application rate x Conversion factor (lb ai/acre = 11.209 Fg/cm<sup>2</sup>) x fraction of initial ai retained on foliage (20% for ornamentals and 5 % for turf)\* (1-daily dissipation rate)', assuming a daily dissipation of 10%.
- c Dermal Dose = [DFR(Fg/cm<sup>2</sup>) x Transfer coefficient (cm<sup>2</sup>/hr) x conversion factor (1 mg/1,000 Fg) x Exposure duration (8 hours/day) / body weight (70 kg)]
- d MOE = NOAEL (mg/kg/day) / Dermal Dose ( mg/kg/day); where NOAEL = 100 mg/kg/day. An MOE of \$ 100 is acceptable.

## Summary of Postapplication Risk

The risk assessment for occupational postapplication workers indicates that:

- C entry by golf course workers to mow and maintain the turfgrass is acceptable on day of application as soon as the dust has settled;
- C entry by workers in ornamental nurseries following treatments at the 3 lb ai/acre application rate do not reach a MOE of 100 until day 20 for cutting, harvesting, transplanting, pruning, or balling/burlapping; until day 11 for irrigating; and until day 7 for sorting and packing;
- C entry by workers in ornamental nurseries following treatments at the 6 lb ai/acre application rate do not reach a MOE of 100 until day 26 for cutting, harvesting, transplanting, pruning, balling/burlapping; until day 18 for irrigating; and until day 13 for sorting and packing.

## Postapplication Data Gaps and Uncertainties

The following data gaps or uncertainties were associated with this assessment:

- C No chemical-specific exposure or transferable residue data were submitted. As a result, all analyses were completed using surrogate data from sources such as PHED and assumptions related to the behavior and environmental fate of the chemical in the environment (e.g., dissipation of transferable residues).
- C Factors used to calculate postapplication risks (e.g., hours exposure per day) are often based on the best professional judgment due to a lack of pertinent data.

## Residential and Other Non-Occupational Exposures and Risks

### Residential Handler Exposures and Risks

Residential handler exposure assessments were completed by EPA using PHED values to estimate daily unit exposure values. The following assumptions and factors were used in order to complete this exposure assessment:

- C Calculations were completed at the maximum and lowest application rates for specific uses recommended by the trichlorfon labels to bracket risk levels associated with the various use patterns.
- C Generally, the use of PPE and engineering controls are not considered acceptable options for products sold for use by homeowners because they are not available, and/or inappropriate for the exposure scenario (e.g., acceptability rationale is based on a lack of enforcement, available PPE,

and training).

- C PHED values represent a handler wearing typical residential clothing attire of short sleeve shirt, short pants and no gloves.

Residential handler exposure assessments are completed by EPA based on a short sleeve shirt, short pants, and no-glove clothing scenario -- the typical clothing worn by a homeowner in the summer. The Agency does not use risk mitigation measures, such as personal protective equipment or engineering controls, in residential handler assessments, since they are not believed to be appropriate for such users.

Four handler scenarios were assessed for residential handlers: (R1) loading/applying granules to building perimeters using a “push-type” broadcast spreader; (R2) loading/applying granules to residential lawns using a “push-type” broadcast spreader; (R3) applying granules to building perimeters using “hand broadcast” method; (R4) applying granules to ant mounds using “hand broadcast” method.

The calculations of daily inhalation, dermal, and total exposure, dose, and risks were made using the same formulas as presented earlier for occupational handlers. Table 8 provides a description of the residential exposure scenarios. Table 9 presents short-term dermal and inhalation risks to residential handlers. Both low and high application rates have been used to estimate potential “low” and “high” end risks. Since the FQPA safety factor applies to non-occupational exposures to trichlorfon, acceptable MOEs for dermal and inhalation exposure must be at least 1,000.

**Table 8. Residential Exposure Scenario Descriptions for the Use of Trichlorfon**

Exposure Scenario (Number)	Data Source	Standard Assumptions <sup>a</sup>	Comments <sup>b</sup>
Mixer/Loader/Applicator Descriptors			
Loading/Applying Using a Push-type Granular Spreader (R1, R2)	SOPs for Residential Exposure Assessments (12/-97)	700 ft <sup>2</sup> for perimeter treatments based on a house 30 x 40 x 30 x 40 feet with a 5 foot wide band and 0.5 acres for turfgrass application.	<b>Baseline:</b> Hands = C grade, and inhalation data = B grade. Hand = 15 replicates; dermal = 0-15 replicates; and inhalation = 15 replicates. Low confidence in hands and dermal data, and high confidence in inhalation data. A 50% protection factor was used to "backcalculate" a short sleeved shirt value from long sleeve shirt data.  <b>PPE and Engineering Controls:</b> Not feasible for assessment.
Loading/Applying Granulars by Hand (R3, R4 )	SOPs for Residential Exposure Assessments (12/-97)	700 ft <sup>2</sup> for perimeter treatments based on a house 30 x40 x 30x 40 feet with a 5 foot wide band and treatment of 5 ant mounds per day.	<b>Baseline:</b> Dermal, hands and inhalation data = ABC grade. Hands, dermal and inhalation = 16 replicates. Medium confidence in all data. A 90% PF was applied to gloved hands data to backcalculate "no glove" hand exposure.  <b>PPE and Engineering Controls:</b> Not feasible for assessment

<sup>a</sup> Standard Assumptions based on HED estimates.

<sup>b</sup> "Best Available" grades are defined by HED SOP for meeting Subdivision U Guidelines. Best available grades are assigned as follows: matrices with grades A and B data and a minimum of 15 replicates; if not available, then grades A, B and C data and a minimum of 15 replicates; if not available, then all data regardless of the quality and number of replicates. Data confidence are assigned as follows:

High = grades A and B and 15 or more replicates per body part

Medium = grades A, B, and C and 15 or more replicates per body part

Low = grades A, B, C, D and E or any combination of grades with less than 15 replicates



**Table 9. Baseline Residential Dermal, Inhalation, and Total MOEs for Trichlorfon**

Exposure Scenario (Scen. #)	Dermal Unit Exposure <sup>a</sup> (mg/lb ai)	Inhalation Unit Exposure <sup>b</sup> (Fg/lb ai)	Crop Type or Use <sup>c</sup>	Application Rate (lb ai/acre)	Amount Handled per Day <sup>e</sup>	Dermal <sup>f,g</sup>		Inhalation <sup>h,i</sup>		Combined <sup>j,k</sup>	
						Daily Dose <sup>f</sup> (mg/kg/-day)	MOE <sup>g</sup> (1,000 needed)	Daily Dose <sup>h</sup> (mg/kg/day)	MOE <sup>i</sup> (1,000 needed)	Daily Dose <sup>j</sup> (mg/kg/day)	MOE <sup>k</sup> (1,000 needed)
Mixer/Loader/Applicator Risks											
Loading/Applying with a Push Type Spreader (R1)	3.0	6.3	perimeter	0.000062 lb ai/-ft <sup>2</sup>	700 ft <sup>2</sup>	0.0019	54,000	3.9E-06	880,000	0.0019	51,000
				0.0000125 lb ai/ft <sup>2</sup>		0.00040	270,000	7.9E-07	4,400,000	0.00040	250,000
turf			8.2 lb ai/acre	0.5 acres	0.18	570	3.7E-04	9,300	0.18	540	
			5.4 lb ai/acre		0.12	860	2.4E-04	14,000	0.12	810	
			1.1 lb ai/acre		0.024	4,200	5.0E-05	70,000	0.024	4,000	
Applying Granulars by Hand (R3)			430	470	perimeter	0.000050 lb ai/-ft <sup>2</sup>	700 ft <sup>2</sup>	0.22	470	2.4E-04	15,000
	0.0000125 lb ai/ft <sup>2</sup>	0.054				1,900		5.9E-05	59,000	0.054	1,800
Texas Harvester ant mounds	0.025 lb ai/-mound	5 ant mounds			0.77	130	8.4E-04	4,100	0.77	130	
	0.013 lb ai/-mound				0.40	250	4.4E-04	7,900	0.40	240	

**Footnotes:**

- a Dermal unit exposure values from Residential SOPs draft December 1997. Baseline dermal exposure assumes short pants, short sleeved shirt, and no gloves clothing scenario.
- b Inhalation unit exposure values from Residential SOPs draft December 1997 (no respirator).
- c Crop type or use
- d Application rates are the high and low application rates presented on EPA registered labels. Rates are taken from the following labels:  
R1: perimeter 3125-400 and 655-791; turf, 3125-507 and 3125-400, and  
R2: perimeter 655-790 and 655-791; and mounds 655-791.
- e Amount handled per day values are EPA estimates of acreage treated found in the Residential SOPs draft December 1997. Perimeter area treated is based on a house 30 x 40 x 30 x 40 feet and a 5 foot wide band. A 5 mound estimate was based on communications with Dr. Mark Dow, RD.
- f Dermal daily dose (mg/kg/day) = daily unit exposure (mg/lb ai) x application rate (lb ai/acre) x amount handled per day (acres) / body weight (70 kg).
- g Dermal MOE = NOAEL (100 mg/kg) / daily dose (mg/kg/day).
- h Inhalation daily dose (mg/kg/day) = inhalation unit exposure (Fg/lb ai) x application rate (lb ai/acre) x amount handled per day (acres) x conversion factor (1 mg/1,000 Fg) / body weight (70 kg).
- i Inhalation MOE = NOAEL (3.45 mg/kg/day) / daily dose (mg/kg/day).
- j Total dermal dose = daily dermal dose (mg/kg/day) + daily inhalation dose (mg/kg/day)

k    Total MOE = 1 / [(1 / dermal MOE) + (1 / inhalation MOE)].

## **Summary of Risk for Homeowner-Handlers**

### **Handler Scenarios with Risk Concerns**

The risk assessment indicates that for residential handlers risks from combined dermal and inhalation exposures are below the level of concern (i.e., the MOE >1000) for the following scenarios:

- C    (R1) loading/applying granules to building perimeters using a “push-type” broadcast spreader at the high and low application rate;
- C    (R2) loading/applying granules to residential lawns using a “push-type” broadcast spreader at the low application rate; and
- C    (R3) applying granules to building perimeters using “hand broadcast” method at the low application rate.

The risk assessment indicates that for residential handlers risks from combined dermal and inhalation exposures exceed the level of concern (i.e., the MOE <1000) for the following scenarios:

- C    (R2) loading/applying granules to residential lawns using a “push-type” broadcast spreader at the high application rate;
- C    (R3) applying granules to building perimeters using “hand broadcast” method at the high application rate; and
- C    (R4) applying granules to ant mounds using “hand broadcast” method at the high and low application rate.

Several handler assessments were completed using “low quality” PHED data due to the lack of a more acceptable dataset.

## **Non-occupational Postapplication Exposures and Risks**

### **Postapplication Exposure Scenarios**

EPA has determined that there are potential postapplication exposures to residents, including children, in the following scenarios.

- dermal postapplication risks to toddlers and adults from granular formulations when reentering treated lawns (see Table 10);
- dermal postapplication risks to toddlers and adults from soluble powder formulations when reentering treated lawns (see Table 10);
- oral postapplication risks to toddlers from “hand-to-mouth” (i.e., ingestion of grass,

soil, granular pellets, or hand-to-mouth contact) exposure when reentering lawns treated with granular formulations (see Table 12);

- oral post application risks to toddlers from “hand-to-mouth” (i.e., ingestion of grass, soil, granular pellets, or hand-to-mouth contact) exposure when reentering lawns treated with soluble powder formulations (see Table 12); and
- golfer postapplication risks to youths (12 yrs) and adults while playing 18 holes of golf (see Table 10).

### **Data Source Descriptions for Scenarios Considered**

No chemical-specific postapplication human reentry or transferable residue data were submitted in support of the reregistration of trichlorfon. Therefore, post-application exposures to residents were estimated using assumptions from the Standard Operating Procedures (SOPs) for Residential Exposure Assessments. In addition to the high-end estimates from the SOPs, a low end estimate has been included as a range finder.

### **Assumptions Used in Postapplication Exposure Calculations**

The assumptions used in the calculations for residential postapplication risks are presented in Table 11.

### **Postapplication Exposure and Risk Estimates**

Post-application dermal exposures to residents were estimated using assumptions from the Standard Operating Procedures (SOPs) for Residential Exposure Assessments and are representative of children (3 year old toddlers) reentering treated lawns. In addition to the high-end estimates from the SOPs, a low end estimate has been included as a range finder. In addition to the dermal post-application exposure estimated for toddlers, there is the potential for oral hand-to-mouth exposure (from licking fingers or the incidental ingestion of granules, or treated grass or soil). This risk has been estimated and combined with dermal MOEs for an aggregate risk assessment.

Since the FQPA safety factor applies to trichlorfon, acceptable MOEs for residential postapplication dermal and incidental ingestion exposure must be at least 1,000.

## Summary of Postapplication Risk

### Postapplication Scenarios with Risk Concerns

The risk assessment for residential postapplication exposures shown in Tables 12 and 13 indicates that:

- C for dermal postapplication exposures and risk to toddlers reentering treated lawns, risks exceed EPA's level of concern for both low and high-end dermal exposures.
- C for dermal postapplication exposures and risk to youths and adults reentering treated golf courses to play golf, risks did not exceed EPA's level of concern for the low and high end dermal exposures.
- C for oral ingestion of granular pellets, risks exceeded EPA's level of concern for both the low and high end estimations.
- C for oral hand-to-mouth exposure, risks exceeded EPA's level of concern for the high end estimations.
- C for ingestion of grass, risks did not exceed EPA's level of concern at either assessed application rate.
- C for soil ingestion, risks were not a concern at either the low or high end estimates.
- C all combined dermal and incidental ingestion exposures exceeded EPA's level of concern, particularly for the dermal/pellet ingestion estimates.

### Data Gaps and Uncertainties

The following data gaps or uncertainties were associated with this assessment:

- C No chemical-specific exposure or transferable residue data were submitted. As a result, all analyses were completed using surrogate data from sources such as PHED and assumptions related to the behavior and environmental fate of the chemical in the environment (e.g., dissipation of transferable residues).
- C Factors used to calculate postapplication risks (e.g., hours exposure per day or average reentry day) are often based on the best professional judgment due to a lack of pertinent data.

**Table 10. Dermal Postapplication Risks to Toddlers and Adults from Granular and Soluble Powder Formulations When Reentering Treated Lawns**

Scenario	Range Finder <sup>1</sup>	Application Rate (lb ai/acre)	Conversion Factor (lb ai/acre to µg/cm <sup>2</sup> )	Fraction of Residue Retained	Transfer Coefficient (cm <sup>2</sup> /hr)	Exposure Duration (hours)	Body Weight (kg)	Daily Dermal Dose <sup>2</sup> (mg/kg/day)	Dermal MOE <sup>3</sup> (UF >1000)
<b>Toddler</b>	Low End	5.4	11.209	0.01	8,700	0.33	15	0.12	860
	High End	8.2	11.209	0.05	8,700	2	15	5.3	19
<b>Adult</b>	Low End	5.4	11.209	0.01	43,000	0.33	70	0.12	810
	High End	8.2	11.209	0.05	43,000	2	70	5.6	18
<b>Golfer - Youth</b>	Low End	5.4	11.209	0.01	100	4	44	0.0055	18,000
	High End	8.2	11.209	0.05	100	4	44	0.042	2,400
<b>Golfer - Adult</b>	Low End	5.4	11.209	0.01	100	4	70	0.0035	29,000
	High End	8.2	11.209	0.05	100	4	70	0.026	3,800

<sup>1</sup> Low end ranges are derived from the lowest labeled application rates (except for a single granular label that listed a low rate of 1.089 lb ai/A -- EPA Reg. 3125-400), an estimated retained residues of 1 percent of the application rate, and estimated hours exposed as 1/3 hours. The high end ranges are derived from the highest labeled rates, estimated retained residues of 5 percent of the application rate, and estimated hours exposed as 2 hours. Golfer durations are assumed to be 4 hours for an 18-hole round of golf.

<sup>2</sup> Daily Dermal Dose (mg/kg/day) = [Application rate (lb ai/acre) x conversion factor (µg/cm<sup>2</sup>/lb ai per acre) x fraction of residue retained x Transfer Coefficient (cm<sup>2</sup>/hr) x unit conversion (1 mg/1000 µg) x Exposure Duration (hrs/day)]/Body Weight (kg). Inputs and calculations are derived from the SOPs for Residential Exposure Assessments, except for golfers. A measured transfer coefficient for golfing is not available, and therefore is estimated to be 100 cm<sup>2</sup>/hr because of the low dermal contact activity (i.e., walking).

<sup>3</sup> Postapplication Dermal MOE = Dermal NOAEL (100 mg/kg/day)/Daily Dermal Dose (mg/kg/day). MOEs are reported to two significant figures; uncertainty factor (i.e., MOE) is 1,000.

**Table 11. Assumptions for oral dose estimation when toddlers ingest grass, soil, granular pellets or have hand-to-mouth contact**

Parameter	Assumption
Application rate conversion (lb ai/acre to $\mu\text{g}/\text{cm}^2$ )	11.209
Application rate	C 5.4 (lb ai/acre) - Low Rate C 8.2 (lb ai/acre) - High Rate
Fraction of residue retained on turf after application	C 0.01 (1%) - Low End C 0.05 (5%) - High End
Hours exposed per day	C 0.33 (20 minutes) - Low End C 2 hours - High End
Body weight	C 15 kg - toddler C 70 kg - adult C 44 kg - youth (12 yrs)
Surface area hand	350 $\text{cm}^2$
Hand-to-mouth rate	1.56 events/hour
Ingestion rate	C 25 $\text{cm}^2/\text{day}$ - grass C 100 mg/day - soil C 0.3 g/day - granules
Percent active ingredient in granule formulations	C 0.05 (5%) - Low rate C 0.062 (6.2 %) - High Rate
Oral NOAEL based on rat study	10 mg/kg/day (UF >1,000)

**Table 12. Oral Postapplication Risks to Toddlers from “Hand-to-Mouth” and Ingestion Exposure When Reentering Lawns Treated with Granular and Soluble Powder Formulations**

Type of Exposure	Range Finder <sup>1</sup>	Application Rate (lb ai/acre)	Conversion Factor (lb ai/acre to µg/cm <sup>2</sup> )	Fraction of Residue Retained	Ingestion Rate or Other Assumptions	Exposure Duration (hours)	Body Weight (kg)	Daily Oral Dose <sup>2</sup> (mg/kg/day)	Oral MOE <sup>3</sup> (UF >1,000)
<b>Hand to Mouth<sup>4</sup></b>	Low End	5.4	11.209	0.01	350 cm <sup>2</sup> (hand surface area) 1.56 events/hr	0.33	15	0.0073	1,400
	High End	8.2		0.05		2		0.33	30
<b>Grass<sup>5</sup></b>	Low End	5.4		0.01	25 cm <sup>2</sup> /day	0.33		0.0010	9,900
	High End	8.2		0.05		2		0.0077	1,300
<b>Soil<sup>6</sup></b>	Low End	5.4		100	100 mg/day ingestion & 0.67 cm <sup>3</sup> /- gm soil	0.33		0.00027	37,000
	High End	8.2		100		2		0.00041	24,000
<b>Granules<sup>7</sup></b>	Low End	NA	NA	0.05	0.3 g/day	NA		1.0	10
	High End	NA		0.062		NA		1.2	8.1

**Footnotes:**

- <sup>1</sup> Low end ranges are derived from the lowest labeled app. rates (except for a single granular label that listed a low rate of 1.089 lb ai/A -- EPA Reg. 3125-400), an estimated retained residues of 1 percent, and estimated hrs. exposed as 1/3 hours. High end ranges are derived from the highest labeled rates, estimated retained residues of 20 percent, and estimated hrs. exposed as 2 hrs.
- <sup>2</sup> Daily Oral Dose (mg/kg/day) formulas are presented in the following footnotes. Inputs and calculations are derived from the SOPs for Residential Exposure Assessments.
- <sup>3</sup> Postapplication oral MOE = Oral NOAEL(10 mg/kg/day)/Daily Oral Dose(mg/kg/day). Oral NOAEL determined from a rat study. MOEs are reported to two significant figures; an acceptable MOE is at least 1,000.
- <sup>4</sup> **Hand-to-mouth** oral dose to toddlers on the day of treatment (mg/kg/day) = [application rate(lb ai/acre) x fraction of residue retained after application x 11.209 (conversion factor) x surface area hands (350 cm<sup>2</sup>) x hand-to-mouth rate(1.56 events/hour) x exp. time (hr/day) x .001 mg/µg] ÷ 15 kg bw.
- <sup>5</sup> **Grass** oral dose to toddlers on the day of treatment (mg/kg/day) = [application rate(lb ai/acre) x fraction of residue retained after application ( 5 or 1 %) x 4.54E+08 Fg/lb conversion factor x 2.47E-08 acre/cm<sup>2</sup> conversion factor) x ingestion rate of grass (25 cm<sup>2</sup>/day) x .001 mg/µg] ÷ 15 kg bw.
- <sup>6</sup> **Soil** oral dose to toddlers on the day of treatment (mg/kg/day) = [(application rate(lb ai/acre) x fraction of residue retained on uppermost 1 cm of soil (100%) x 4.54E+08

Fg/lb conversion factor x 2.47E-08 acre/cm<sup>2</sup> conversion factor x 0.67 cm<sup>3</sup>/g soil conversion factor) x 100 mg/day ingestion rate x 1.0E-06 g/Fg conversion factor] ÷ 15 kg bw.

7 Oral dose to toddlers from **granular pellet ingestion** (mg/kg/day) = [Granule ingestion rate (0.3 g/day) x Fraction of ai of granule formulations x 1000mg/g] ÷ 15 kg bw.



**Table 13. Combined Aggregated Risk Assessment from Dermal and Oral Exposures to Toddlers on Turfgrass**

Type of Exposure	Range Finder	Application Rate (lb ai/acre)	Dermal MOE <sup>a</sup> (UF >1,000)	Oral MOE <sup>b</sup> (UF >1,000)	Combined MOEs <sup>c</sup> (UF >1,000)
Dermal + Hand to Mouth	Low End	5.4 lb ai/acre	860	1,400	530
	High End	8.2 lb ai/acre	19	30	12
Dermal + Incidental Turfgrass Ingestion	Low End	5.4 lb ai/acre	860	9,900	790
	High End	8.2 lb ai/acre	19	1,300	18
Dermal + Incidental Soil Ingestion	Low End	5.4 lb ai/acre	860	37,000	840
	High End	8.2 lb ai/acre	19	24,000	19
Dermal + Incidental Ingestion of Granules	Low End	5.4 lb ai/acre	860	10	9.9
	High End	8.2 lb ai/acre	19	8.1	5.6

**Footnotes:**

a Dermal MOEs from Table 10

b Oral MOEs from Table 12

c Combined Aggregated MOE =

and UF (Uncertainty Factor) is 1,000.

$$MOE = \frac{1}{\frac{1}{Dermal\ MOE} + \frac{1}{Oral\ MOE}}$$